

CLAIMS

1. A method for manufacturing a planar light circuit comprising the steps of:
 - (a) removing a portion of an exposed surface of a substrate to form a first cavity;
 - (b) depositing a layer of first optical material on the exposed substrate surface in an amount sufficient to fill the first cavity with the first optical material and to cover at least a portion of the exposed substrate surface; and
 - (c) removing at least a portion of the first optical material layer to form at least one planar waveguide.
2. The method of claim 1 wherein at least a portion of the first optical material layer is removed by polishing.
3. The method of claim 1 wherein removing step (c) is accomplished by chemical mechanical planarization.
4. The method of claim 3 wherein the chemical mechanical planarization comprises the further steps of:
 - (i) applying a polishing composition to the first optical material layer; and
 - (ii) removing at least a portion of the first optical material layer from the substrate by bringing a polishing substrate into contact with the first optical material layer and thereafter moving the polishing substrate in relation to the exposed surface of the fiber core.
5. The method of claim 1 wherein the first optical material layer is removed in step (c) until the substrate surface and the first optical material layer surface are essentially co-planar.
6. The method of claim 1 wherein at least one film layer is deposited in the first cavity before the first optical material is deposited in the first cavity.
7. The method of claim 6 wherein the film layer is selected from the group of layers consisting of a stress compensating oxide layer, an antireflective material layer, a conformal film layer and layer combinations thereof.
8. The method of claim 1 wherein a feature is added to the planar light circuit by the further steps comprising:
 - (i) removing at least a portion of the first optical material located in the first cavity to form a second cavity;

(ii) depositing a second optical material into the second cavity in an amount sufficient to fill the second cavity with the second optical material; and

(iii) removing at least a portion of the second optical material from the substrate to form a planar light circuit feature.

9. The method of claim 8 wherein the second optical material has a refractive index that is different from the refractive index of the first optical material.

10. The method of claim 8 wherein the feature is associated with one optical waveguide.

11. The method of claim 8 wherein the feature is associated with at least two optical waveguides.

12. The method of claim 8 wherein the feature is selected from the group consisting of spatial filters, anamorphic beam shapers, aberration correctors, attenuation and beam jumpers, athermalization, Birefringence, polarizers, separators, thermal conductivity correctors, solubility correctors, phase shifters, beam steerers, optical power self-limiters, sharp angle turns, light generators, light amplifiers, lasers and combinations thereof.

13. The method of claim 8 wherein the second optical material is removed from the substrate by chemical mechanical planarization.

14. The method of claim 13 wherein the chemical mechanical planarization comprises the further steps of:

(i) applying a polishing composition to the exposed second optical material surface; and

(ii) removing at least a portion of the second optical material from the substrate by bringing a polishing substrate into contact with the second optical material and thereafter moving the polishing substrate in relation to the exposed surface of the fiber core.

15. The method of claim 14 wherein the second optical material is removed until the first optical material and the second optical material are essentially co-planar.

16. The method of claim 4 or 14 wherein the polishing substrate is a polishing pad.

17. The method of claim 16 wherein the polishing pad is a fixed abrasive polishing pad.

18. The method of claim 4 or 14 wherein the polishing composition includes abrasive particles.

19. The method of claim 14 wherein the second optical material is removed until the substrate surface, the first optical material layer surface and the second optical material layer surface are essentially co-planar.

20. The method of claim 1 wherein the first optical material is selected from an organic material, and inorganic material, or a combination thereof.

21. The method of claim 20 wherein the first optical material includes a polymer.

22. A planar light circuit including a substrate having at least one optical waveguide wherein the optical waveguide comprises two or more optical materials located in a cavity in the substrate.

23. The planar light circuit of claim 22 wherein the substrate has a surface and the optical materials each have a surface and wherein the substrate surface and the optical material surfaces are essentially co-planar.

24. The planar light circuit of claim 23 having an RMS surface roughness less than about 100Å

25. The planar light circuit of claim 20 wherein at least one optical material forms an optical waveguide feature.

26. The planar light circuit of claim 27 wherein the optical waveguide feature is made from a second optical material having a diffractive index that is different from the diffractive index of the optical waveguide material.

27. The planar light circuit of claim 26 wherein the optical waveguide feature has a polished surface.

28. The planar light circuit of claim 27 wherein the optical waveguide includes a polished surface that is essentially co-planar with the polished surface of the optical waveguide feature.

29. The planar light circuit of claim 28 wherein the polished surface has an RMS roughness less than about 10Å.

30. The planar light circuit of claim 23 wherein the optical waveguide feature is associated with one optical waveguide.

31. The planar light circuit of claim 23 wherein the optical waveguide feature is associated with at least two optical waveguides.

32. The planar light circuit of claim 23 wherein the optical waveguide feature is selected from the group consisting of spatial filters, anamorphic beam shapers, aberration correctors, attenuation and beam jumpers, athermalization, Birefringence, polarizers, separators, thermal conductivity correctors, solubility correctors, phase shifters, beam steerers, optical power self-limiters, sharp angle turns, light generators, waveguide amplifiers, waveguide lasers, and combinations thereof.

33. The planar light circuit of claim 32 wherein the optical feature is a waveguide amplifier.

34. The planar light circuit of claim 32 wherein the optical feature is a waveguide laser.